

UNCLASSIFIED

AD 267 576

*Reproduced
by the*

**ARMED SERVICES TECHNICAL INFORMATION AGENCY
ARLINGTON HALL STATION
ARLINGTON 12, VIRGINIA**



UNCLASSIFIED

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

ASTIA

CATALOGED BY

AS AD NO.

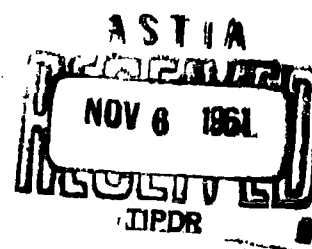
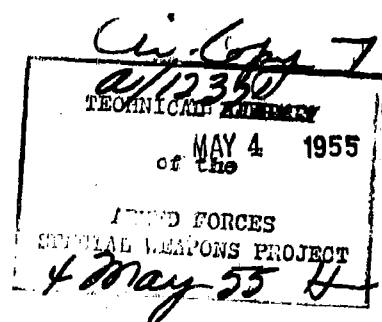
267 576

267 576

BRL

TECHNICAL NOTE No. 950

AFSWP No. 771



A Rugged Blast-Sensitive Switch

WILLIAM C. STANGE

XEROX
62-1-4

DEPARTMENT OF THE ARMY PROJECT No. 503-04-002
ORDNANCE RESEARCH AND DEVELOPMENT PROJECT No. TB3-0112J

BALLISTIC RESEARCH LABORATORIES



ABERDEEN PROVING GROUND, MARYLAND

BALLISTIC RESEARCH LABORATORIES

TECHNICAL NOTE NO. 950

AFSWP NO. 771

October 1954

A RUGGED ELAST-SENSITIVE SWITCH

William C. Stange

Department of the Army Project No. 503-04-002
Ordnance Research and Development Project No. TB3-0112J

Funds for this work were supported by the
Armed Forces Special Weapons Project.

ABERDEEN PROVING GROUND, MARYLAND

BALLISTIC RESEARCH LABORATORIES

TECHNICAL NOTE NO. 950

WCStange/psg
Aberdeen Proving Ground, Md.
October 1954

A RUGGED BLAST-SENSITIVE SWITCH

ABSTRACT

The design and construction of a rugged, weatherproof, blast-sensitive switch which has been tested at BRL are described in detail. A diaphragm is used in conjunction with a small switch producing a unit which is sensitive to shock pressure as low as 0.7 psi.

INTRODUCTION

The Corps of Engineers desired that a rugged, blast-sensitive switch be designed to operate closure devices for air intake and exhaust openings in protective structures.

The following requirements were requested and accordingly, were incorporated into the design of the trigger unit which was developed.

1. Weatherproof
 - a. Corrosion resistant
 - b. Sun, rain, wind and snow-proof
 - c. Wide temperature working range
2. Long life without adjustment
3. Simple construction
 - a. Readily mounted
 - b. Easily assembled and adjusted
4. Rugged
5. Sensitive to 2 lbs/in² blast pressure or less
6. Relatively tamperproof

DESIGN AND CONSTRUCTION OF TRIGGER UNIT

In the design of the trigger unit, simplicity has been stressed so that the unit can be assembled by anyone familiar with its operation. The unit consists essentially of three sections: the body assembly, the diaphragm, and the switch. Drawings 1 - 9 are attached, which show in detail the trigger unit assembly and its various parts.

A pin plunger type miniature microswitch was used because of its small size, 7 ounce operating force, 0.030 inch pretravel, 1 ounce release force, 0.010 inch contact break distance, and overall rugged construction.

The design problem was essentially to mount a diaphragm exposed to the atmosphere so that it could be adjusted to bear against the switch and to encase this working element in a protective body. For reasons of simplicity and watertightness the wires to the switch were conveyed through the body (see Drawing 2) and around the diaphragm assembly (Draw-

ings 5, 6 and 7). The diaphragm assembly screws into the body bringing the diaphragm to bear upon the switch. By adjusting the position of the diaphragm assembly a wide range of sensitivity may be obtained. A small spanner wrench is used to emplace the diaphragm assembly and also to adjust the sensitivity of the unit.

A large nut (Drawing 3) is used to hold the body (Drawing 2) rigidly to the mount (Drawing 4). The mount is threaded on to a convenient pipe support when used in the field. The diaphragm is ported to the atmosphere by means of a concentric ring of 1/2 inch holes in the body (Drawing 2).

Through the liberal use of aluminum an easily machinable and weatherproof trigger unit was designed. Tests have shown that weatherproofing was improved by applying rubber cement to the threads of the diaphragm assembly after it was properly adjusted for sensitivity. Further simplification and compactness could probably be obtained if quantity manufacture were contemplated.

RESULTS OF TEST

The trigger unit was assembled using a 0.005 inch thick brass diaphragm and mounted one foot from the end of the 2 1/4 inch Ballistic Research Laboratories Shock Tube. The following results were obtained with the apparatus as described.

<u>SHOT NUMBER</u>	<u>SWITCH CLOSURE</u>	<u>SHOCK PRESSURE AT TRIGGER UNIT</u>
1	Yes	1.4 PSI
2	Yes	0.7
3	Yes	7.3
4	Yes	10.3
5	No	0.8

Switch closure was obtained on all shots except for shot number 5. Failure of shot 5 was undoubtedly due to a small indentation in the diaphragm caused by shot 4 deforming the diaphragm around the switch plunger. Since successful repetitive operation is not a requirement, this failure was not considered serious.

Futher shock tests have been made at intervals for a period of seven months during which time the unit was exposed to the weather. Positive operation of the switch occurred in every test with no failures.

The switch design is therefore considered adequate for the use for which it was intended.

William C. Stange

Wm C. Stange

0 1 2
INCH

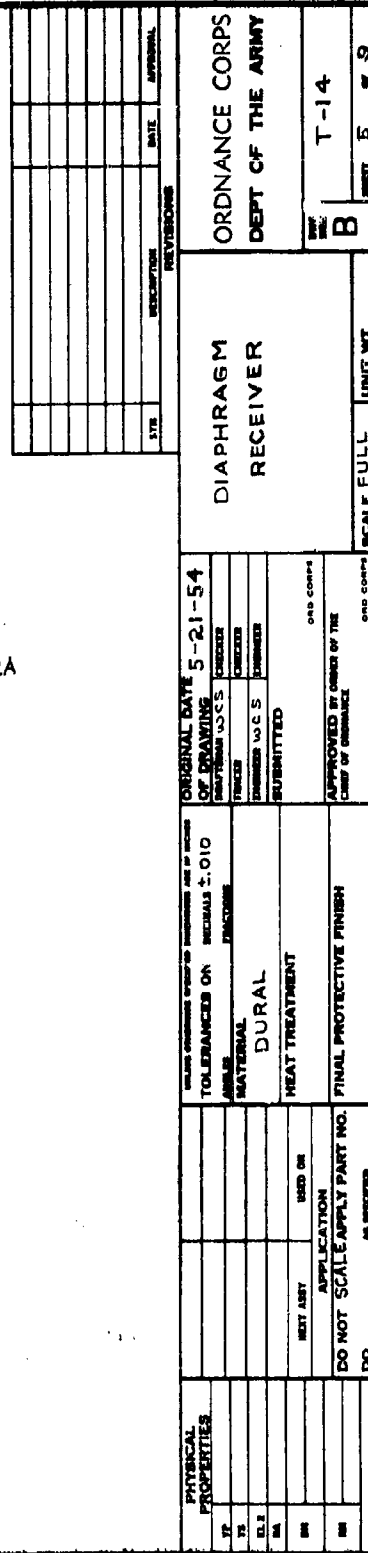


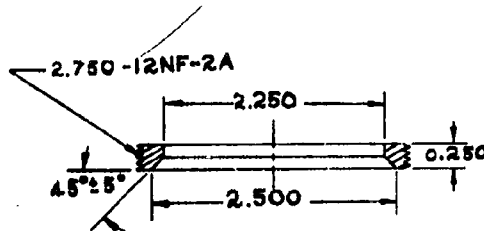
B2606

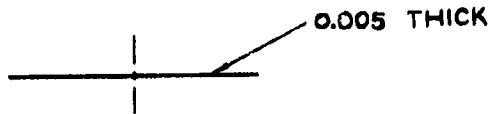
ABERDEEN PROVING GROUND 30 September 1954
Pressure Sensitive Switching Device.



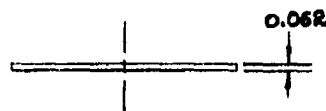
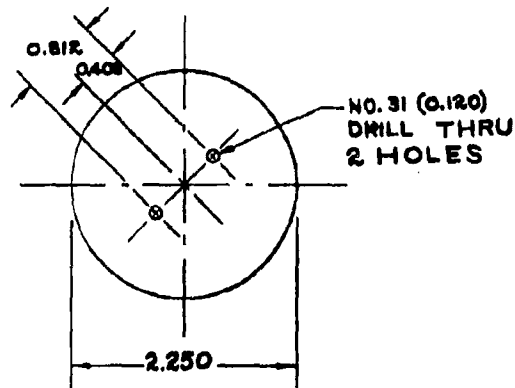
		ORIGINAL DATE 5-24-54 OF DRAWING DRAWN BY CHECKED TRACED EXAMINED W.C.S. SUBMITTED		ORDNANCE CORPS DEPT OF THE ARMY T-13 SHEET 4 OF 9	
		TOLERANCES ON DIMENSIONS ±.010 MATERIAL DURAL HEAT TREATMENT FINISH PROTECTIVE FINISH DO NOT SCALE APPLY PART NO. AS SHOWN		SCALE FULL UNIT WT MOUNT	
PHYSICAL PROPERTIES 12 13 14 15 16		TOLERANCES ON DIMENSIONS ±.010 MATERIAL DURAL HEAT TREATMENT FINISH PROTECTIVE FINISH DO NOT SCALE APPLY PART NO. AS SHOWN		REVISIONS DATE DESCRIPTION APPROVAL	



14



15



PHYSICAL PROPERTIES		TOLERANCES ON DIMENSIONS AND MATERIALS		ORIGINAL DATE 5-26-54		REVISIONS	
IT		ASSEMBLY	ENGINEER	DESIGNER	DATE	APPROVED	
TS		MATERIAL	ENGINEER	DESIGNER			
EL 1		PLASTIC	ENGINEER	DESIGNER			
EN		HEAT TREATMENT	ENGINEER	DESIGNER			
OR		USED ON	ENGINEER	DESIGNER			
IN		APPLICATION	ENGINEER	DESIGNER			
DO NOT SCALE APPLY PART NO.		FINAL PROTECTIVE FINISH		APPROVED BY ORDER OF THE		ORD CORPS	
DO		AS SPECIFIED		CHIEF OF ORDNANCE		ORD CORPS	
INSULATOR				SCALE FULL		UNIT WT	
ORDNANCE CORPS				DEPT OF THE ARMY		A-17	
B				SHEET 8		OF 9	

		SYN		DESCRIPTION		REVISIONS		DATE		APPROVAL			
PHYSICAL PROPERTIES JT TS EL HA ME		APPLICATION DO NOT SCALE APPLY PART NO. DO		MATERIAL DURAL		HEAT TREATMENT		FINAL PROTECTIVE FINISH		ORIGINAL DATE 6-3-54 OF DRAWING DESIGNED W.C.S. CHECKED DRAWN W.C.S. SUBMITTED		ORDNANCE CORPS DEPT OF THE ARMY	
TOLERANCES ON DIMENSIONS FRACTIONS DECIMALS ±.010		HEAT TREATMENT DURAL		MATERIAL DURAL		HEAT TREATMENT		FINAL PROTECTIVE FINISH		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE		SCALE 2:1 UNIT WT	
DO NOT SCALE APPLY PART NO. DO		APPLICATION DO NOT SCALE APPLY PART NO. DO		MATERIAL DURAL		HEAT TREATMENT		FINAL PROTECTIVE FINISH		APPROVED BY ORDER OF THE CHIEF OF ORDNANCE		SCALE 2:1 UNIT WT	

DISTRIBUTION LIST

<u>No. of Copies</u>	<u>Organization</u>	<u>No. of Copies</u>	<u>Organization</u>
2	Chief of Ordnance Department of the Army Washington 25, D. C. Attn: ORDTB - Bal Sec ORDTX-AR	1	Officer-in-Charge U. S. Naval Civil Engineering Research & Evaluation Lab. U. S. Naval Construction Bn Center Fort Huachuca, California Attn: Code 753
4	Chief, Bureau of Ordnance Department of the Navy Washington 25, D. C. Attn: Re3	3	Commander Wright Air Development Center Wright-Patterson Air Force Base, Ohio Attn: WCOESP
2	Commander U. S. Naval Ordnance Lab. White Oak Silver Spring 19, Maryland Attn: Explosives Division	1	Commander Air Research & Development Command P. O. Box 1395 Baltimore, Maryland Attn: RDDN
1	Commander Naval Ordnance Test Station China Lake, California Attn: Technical Library	1	Commander Air Force Cambridge Research Center 230 Albany Street Cambridge 39, Massachusetts Attn: CRW, Atomic Warfare Directorate
1	Commanding Officer U. S. Naval Medical Research Institute National Naval Medical Center Bethesda, Maryland	2	Director of Intelligence U. S. Air Force Washington 25, D. C. Attn: AFOIN-1B2
2	Commander Naval Proving Ground Dahlgren, Virginia	3	Commander Air Force Special Weapons Center Kirtland Air Force Base, New Mexico Attn: Library
2	Chief of Naval Research Department of the Navy Washington 25, D. C. Attn: LTJG F. McKee, Dr. Joseph B. Keller	2	Director Project RAND Department of the Air Force Santa Monica, California Attn: Nuclear Energy Div. Mr. Marc Peter

DISTRIBUTION LIST

<u>No. of Copies</u>	<u>Organization</u>	<u>No. of Copies</u>	<u>Organization</u>
1	Director of Research & Development DCS/D USAF Washington 25, D. C. Attn: Combat Components Division	1	National Advisory Committee for Aeronautics Langley Aeronautical Lab. Langley Field, Virginia Attn: Mr. John Stack
2	Commander Air Materiel Command Wright-Patterson Air Force Base, Ohio Attn: MCAIDS	1	Director Los Alamos Scientific Lab. P. O. Box 1663 Los Alamos, New Mexico Attn: J-Division
6	Commanding General Field Command AFSWP P. O. Box 5100 Albuquerque, New Mexico	1	National Advisory Committee for Aeronautics 1512 H St. N.W. Washington, D. C. Attn: Materials Research Coordination Group
2	Commanding General Field Command AFSWP P. O. Box 5100 Albuquerque, New Mexico Attn: Tech Training Group	1	Director USAEC Construction Division Washington 25, D. C. Attn: Mr. C. Beck
9	Chief Armed Forces Special Weapons Project P. O. Box 2610 Washington 25, D. C. Attn: Blast Branch	1	Chief Army Field Forces Ft. Monroe, Virginia Attn: Ass't Chief of Staff for Dev. & Test
1	Director Division of Military Application USAEC Washington 25, D. C. Attn: Dr. Paul Fine	4	Chief of Engineers Department of the Army Washington 25, D. C. Attn: ENGNB Major J. Irving, Jr. Mr. M. D. Kirkpatrick
1	Atomic Energy Commission Division of Biology and Medicine Washington 25, D. C. Attn: Mr. Robert L. Corsbie, Civil Defense Liaison Br.	1	Director Special Weapons Development Office OCAFF Ft. Bliss, Texas

DISTRIBUTION LIST

<u>No. of Copies</u>	<u>Organization</u>	<u>No. of Copies</u>	<u>Organization</u>
1	Director Operations Research Office 7100 Connecticut Avenue Chevy Chase, Maryland Washington 15, D. C. Attn: Library	1	Commanding Officer Picatinny Arsenal Dover, New Jersey Attn: Samuel Feltman Ammunition Laboratories
1	Dr. S. J. Fraenkel Division of Engineering Mechanics Armour Research Foundation Chicago 16, Illinois	1	Commanding General White Sands Proving Ground Las Cruces, New Mexico Attn: Technical Librarian
1	Broadview Research & Development P. O. Box 1093 Burlingame, California Attn: Dr. Richard I. Condit	1	Commanding Officer Jefferson Proving Ground Madison, Indiana
1	Dr. E. B. Doll Stanford Research Institute Palo Alto, California	1	Commanding Officer Engineer Research Laboratories Fort Belvoir, Virginia
1	Dr. R. J. Hansen Massachusetts Institute of Technology Cambridge 39, Massachusetts		
1	Dr. N. M. Newmark Ill. Talbot Laboratory University of Illinois Urbana, Illinois		
1	Dr. Walker Bleakney Princeton University Princeton, New Jersey		
1	Director Applied Physics Division Sandia Corporation P. O. Box 5800 Albuquerque, New Mexico		